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TECHNICAL SUPPORT DOCUMENT

TECHNICAL REVIEW AND EVALUATION
OF THE SOIL VAPOR EXTRACION UNIT GENERAL PERMIT

I. INTRODUCTION

The Soil Vapor Extraction Unit (SVEU) General Permit is a permit for a facility class (Soil Vapor Extraction Units) that contains 10 or more facilities that are similar in nature, have substantially similar emissions, and would be subject to the same or substantially similar requirements. Equipment that is covered under the general permit will be required to have an "Authorization To Operate" (ATO). The ATO will identify the piece of equipment by having the manufacturer, date of manufacture, maximum capacity, and serial number or equipment number along with the hours of operation limitation.

This General Permit has been reopened in order to clarify some confusion regarding the testing and sampling procedures. Additionally, the permit will now allow sources to use catalytic or thermal oxidation units for sites that will not remediate more than 0.052 grams per second of halogenated compounds. Other changes include editorial corrections, formatting, and the authorization of EPA Method TO-15 AZ List.

This General Permit allows for portable SVEUs to move to other locations statewide. The Permittee that applies for an ATO under the general permit shall pay the Department a flat application fee of $500 with the submittal of the permit application. The Permittee must also continue to pay, for each calendar year, the applicable administrative or inspection fees as described in the Arizona Administrative Code Title 18, Chapter 2, Article 5, Section 511 (A.A.C. R18-2-511).

II. DESCRIPTION OF PERMIT CHANGES

A. Halogenated Compounds

The current SVEU General Permit, if using catalytic or thermal oxidation, only allows for the treatment of motor fuel contaminated sites, which do not have any halogenated compounds. Due to the advent of better testing methods, some small amounts of previously undetectable levels of halogenated compounds are now detectable. The permit, however, does not allow any amount of halogenated compounds to be present in the inlet stream if using thermal or catalytic oxidation. In order to allow a source to use thermal or catalytic oxidation when small amounts of halogenated compounds are present, the Department conducted a modeling analysis using a worst case halogenated compound to determine a lower level mass threshold limit for the inlet halogenated compounds. As a result, sources in which tests show the presence of halogenated compounds can operate a thermal or catalytic oxidizer as long as the tested inlet mass flow rate is less than 0.052 g/sec as determined by the Department's modeling analysis.

B. Test Methods

In the current SVEU General Permit, only EPA Method 8260B was identified as a method for analyzing samples for halogenated compounds and benzene. As part of this reopening the Department will also allow the use of EPA Method TO-15 AZ list. EPA Method TO-15 AZ list is a modified Arizona method approved by the Arizona Department of Health Services (ADHS). ADHS approved an additional 31 compounds for the TO-15 method and it is referreed to as Method TO-15 AZ list. The TO-15 method generally uses Summa Canisters for sample collection and has lower detection limits than the 8260B Method.

III. Halogenated Compounds

A. What is a halogenated compound?

A halogenated compound is defined as a compound in which the carbon atoms are bonded to a halogen such as chlorine, bromine and fluorine. For soils being treated with a SVEU device, the most common occurring halogenated compound are those which contain a chlorine atom such as trichloroethylene (TCE). TCE is one of the most prevalent pollutants and is most likely to lead to higher hydrochloric acid (HCL) emissions.

B. Concerns about Halogenated Compounds in Catalytic/Thermal Units

Previously, the General Permit did not authorize the treatment of halogenated compounds as there were concerns that a high concentration of halogenated compounds could create the formation of dioxin/furans (D/F). In order to determine an appropriate level of halogenated compounds that could be treated, the Department reviewed a technical report regarding a study conducted for the California Air Resources Board to determine emission rates for D/F from thermal and catalytic oxidation for a site that is contaminated mainly with TCE. The report tested the inlet to the control device and the outlet to the atmosphere. The results show an increase of total D/F emissions from 0.00000000000045 to 0.0000000000022 lbs/hr. Inputting this outlet emission rate into a modeling analysis demonstrated compliance well within the guidelines of the Article 17 acute and chronic ambient air concentration values.

Another concern with halogenated compounds in the SVEU device is the formation of acid gases such as HCL. In order to limit the production of acid gases exiting the SVEU system, the Department calculated a maximum inlet mass emission rate as seen in Equation 1 below. For this calculation the Department assumed an inlet limit for TCE at 100 part per million by volume (ppmv) which is significantly higher than most test reports of contaminated sites the Department evaluated. The calculation also assumed 100 percent conversion to HCL. In order to be conservative, the source will sum the concentration of all halogenated compounds, not just TCE. The following equation calculates a mass emission rate for a pollutant based on data for concentration and flowrate.

Equation 1:

$$Q_c = \frac{\left(C_c \times F \times MW_c \times 60\ {}^{min}/_{hr} \times 24\ {}^{hrs}/_{day}\right)}{(10^6 \times V)}$$

Where: Q_c = Mass Emission Rate of Pollutant c, lbs/day

C_c = Concentration of Pollutant c, ppmv

F = Flowrate, SCFM

MW_c = Molecular Weight of Contaminant c, = 131.4 lb/lb-mole for TCE

V = Molar Volume = 385.3 ft^3/lb-mol

10^6 = Conversion from parts per million to parts per unit volume

The assumptions used in this example are 200 SCFM and 100 ppmv of TCE. However, the Permittees must input the actual SVEU inlet stream data for the calculations. Inputting these values into the above

equation is as follows:

$$Q_c = \frac{\left(100\ ppmv \times 200\ {}^{Ft^3}/_{min} \times 131.4\ {}^{lb}/_{lb-mole} \times 60\ {}^{min}/_{hr} \times 24\ {}^{hrs}/_{day}\right)}{\left(10^6 \times 385.3\ {}^{Ft^3}/_{lb-mole}\right)}$$

Q_c = 9.82 lbs/day – Converting to grams per second = 0.052 g/sec = 3.1 g/min

This calculated mass emission rate is the maximum allowable halogenated compound inlet rate for the SVEU device. However, since this equation assumes a flowrate of 200 SCFM, the permit limit will be expressed in the permit as the concentration multiplied by the flowrate. Rearranging equation 1 above to solve for concentration multiplied by flowrate is as follows:

Equation 2:

$$C_c \times F = \frac{\left(3.1\ {}^{g}/_{min} \times {}^{1\ lb}/_{454\ g} \times 385.3\ {}^{Ft^3}/_{lb-mole} \times 10^6\right)}{\left(131.4\ {}^{lb}/_{lb-mole}\right)}$$

Cc x F = 20,000 $ppmv\left(\frac{Ft^3}{min}\right)$

Where:

Cc = Sum of all halogenated compounds, ppmv
F = Flowrate, SCFM

Compliance with the permit limit will be calculated in equation 2 above, where the source will input its specific flowrate and sum of halogenated compounds in the inlet to ensure they are below 20,000 $ppmv\left(\frac{Ft^3}{min}\right)$.

In order to determine the outlet concentration of HCL to be used in the modeling analysis a simple ratio was calculated. Since one TCE molecule is assumed to produce 3 molecules of HCL a ratio was performed to determine the outlet HCL emission rate. This ratio is based on the molecular weight of the two molecules:

MW TCE = 131.4 lb/lb-mole,
MW HCL = 36 lb/lb-mole x 3 molecules = 108 lb/lb-mole

This follows as:

Equation 3:

$$\left(\frac{108\ {}^{lb}/_{lb-mole\ HCL}}{131.4\ {}^{lb}/_{lb-mole\ TCE}}\right) \times 0.052\ {}^{g}/_{\sec TCE} = 0.042\ {}^{g}/_{\sec HCL}$$

The mass emission rate calculated above for HCL was used in the modeling analysis to ensure it is within the guidelines set forth in The Arizona Administrative Code (A.A.C) R18-2-1708, Table 3 – Acute and

Chronic Ambient Air Concentrations.

IV. MODELING ANALYSIS

A. Introduction

In order to determine a mass emission rate for halogenated compounds it was necessary to model a standard SVEU configuration. A simple modeling approach was conducted using AERSCREEN, the EPA recommended screening model. The parameters used are listed in Table 1 below:

Table 1: Modeling Parameters

Parameters	Inputs	Input values
Source	Source type	POINT
	Stack height	3.96 m
	Emission rate	1 g/s
	Stack diameter	0.41 m
	Stack exit temperature	588 K
	Stack exit velocity	2.29 m/s
Building	Include building downwash	Yes
	Building height	10 m
	Maximum horizontal dimension	30 m
	Orientation of maximum building dimension to North	90°
	Minimum horizontal dimension	20 m
	Direction of stack from North	0°
	Distance from stack to building center	20 m
Meteorology	Minimum temperature	267.6 K
	Maximum temperature	323.1 K
	Minimum wind speed	0.5 m/s
	Anemometer height	10 m
	Source of surface characteristics	Albedo: .25, B/R: 10, R/L: 0.15
Other inputs	Input units	Metric
	Rural/urban	Rural
	Ambient Distance	1 - 5000 m
	Use flagpole receptors	No

Table 2 on the following page shows the modeling analysis for HCL and Dioxin/Furan emissions. The results demonstrate that the permit limit at 100 ppmv of TCE, assuming full conversion to HCL, as well as the D/F values, are well below the Article 17 standards.

Table 2 – Modeling Results

Pollutant	Emission Rate	Modeled 1-hr Concentration (ug/m3)	Acute Ambient Concentration (ug/m3)	Modeled Annual Concentration (ug/m3)	Chronic Ambient Concentration (ug/m3)
Dioxin/Furan	2.20E-13	6.963E-10	25000	6.96E-11	7.3
HCL at 100 ppmv TCE inlet	0.04	132.93	16000	13.29	20.9

V. LIST OF ABBREVIATIONS

A.A.C. ..... Arizona Administrative Code
EPA ..... The Environmental Protection Agency
ft^3 ..... Cubic Feet
ft ..... Feet
g ..... Grams
HCL ..... Hydrochloric Acid
hr ..... Hour
lb ..... Pound
m ..... Meter
ug/m^3 ..... Microgram per Cubic Meter
s ..... Seconds
TCE ..... Trichloroethylene